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Good Morning Engineers: A Wake up Call

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With all the problems in the world today, when many people wake up in the morning, they are tempted to go back to sleep. There is something exciting about waking up in the morning as an engineer. We run toward problems and we solve problems. Thank goodness for everybody in this room that you are an engineer, someone who supports engineering, or simply supports an engineer enough to come with him or her today.

Let me describe in brief the problems the Grand Challenges can solve. Last night there were 1.3 billion people in the world that did not have to turn off a light switch when they went to bed, because they did not have electricity. Before this day is done, 2.4 billion people will cook on a stove that can deteriorate their health through the harmful smoke. According to the World Health Organization (WHO), 4 million people will die each year from poor indoor air quality.

7.3 billion people are in the biggest chemistry experiment of all time. We are heating up the earth, and there is no way out if it does not work. As Dan Mote described, "That is what the vision was for the Grand Challenges to preserve life in a quality way on this earth." We engineers have the tools and techniques to make that happen.

Now, I want to fast-forward and tell you what you are going to hear from every speaker for the rest of the conference. I will make a prediction. I could be wrong, but I will make a prediction anyway. You are going to hear that on all fourteen Grand Challenges, we have made real progress since February 2008 when they first saw the light of day. It varies, some much more than others, although made progress. All of our speakers will tell you that the progress is not fast enough.

We must pick up the pace from what we are doing today. This conference should be about how do we pick up the pace. Your first question might be, "How much do we need to increase the pace?" Let us say today we are walking at a normal pace. Would walking at a fast pace be fast enough? No, I do not think so. Would a jog be fast enough? No, I do not think so. We are going to have to run. Now, it may not be a sprint, it may be a marathon pace of running, but we are going to have to run. This is a big change from today.

The challenge we have today is how do we take up the pace? I want to share three ideas. I hope they are ideas you will not hear anywhere else in this conference. I tried to pick ones that I did not think would come up and that will be critical to implementing the Grand Challenges, because it is not just about great engineering, it is about implementation.

The first one relates to the people we need to work with us to make this a success that are not engineers. We need governments. We need non-governmental organizations (NGOs). We need companies. Most importantly we need the citizens of the world to be a part of this. This means as we talk to all the constituents that we need, we must talk in terms they will understand. If we just share how great engineering is and how tough the problems are, it will probably turn them off pretty fast. My challenge to you throughout this conference is, when you are thinking about your work or one of the student teams that presented yesterday, describe the benefits first, then talk about the great engineering that goes behind it. I think that is very critical.

Here are a couple of examples from my experience. I work for Shell. We have 43 000 retail fuel stations in the world. I have been very specific. I have told you exactly how many we have. But have I really communicated anything to you? If you are not in the retail fuel business, you probably do not have a good sense of whether 43 000 is a lot or a little. Now if I tell you we are the biggest branded fuel retailer in the world, all of the sudden you think that is must be a lot. If I tell you we have more retail outlets than McDonald's, you may say that is really a lot. Then if I tell you we sell to 10 000 customers every minute, you would say that is fantastic. By the way, we are the largest brand leader of any company in the industry selling to consumers in the world. That same 43 000 put in another perspective really communicates something else. I challenge you as you think about communicating: Speak in terms the receiver of the information can understand and connect to.

In Shell, we are now working to site a major Carbon Capture Project through a surrogate in Scotland. We need the help of the UK government. When we speak with the government, we talk about the 500 000 homes we can provide electricity to without carbon dioxide. We do not talk in the terms that may be more important to us as engineers.

The last example I would like to share with you relates to the idea that when you describe your work, it does not always have to quantitative. When I started my career at DuPont, I remember going into a review about reducing one of our waste products. The debate during the meeting centered on "Is there really enough waste to make an investment worth the cost?" At this particular

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site we had an administration building that was two stories tall. There was a sketch in the room of our administration building that was eleven stories tall. It was a terrible sketch, but you could tell what it was. We all thought we had come to the wrong meeting, because instead of discussing waste product and we assume somebody has a crazy idea to make the building five times higher. The speaker stood up and started to talk. He said, "You all came into this room thinking this waste product was not big enough to make this investment. We have enough of this waste to fill that eleven-story building every year. Can I have your attention to hear my case?" After seeing that sketch, we approved the project. My challenge to you as you talk about your work is to speak in a way that people can understand and relate to.

Point number two: "Brand it." I do not care what it is, brand it. If it can walk, brand it. As a young engineer at DuPont, I remember my first meeting when someone came in and said, "We want to go sell this chemical...titanium dioxide, hydrogen peroxide, or another key chemical we developed." The leader of the group asked, "You want to start a business selling that chemical and you want to call it by the chemical name? This meeting is over." If it is just a chemical, anybody can do that; including all of our competitors. You have to have a brand. And you must have a uniqueness in your technology or we are not interested in it.

As you think about your product, if you just describe it by the technical aspects of the process, I think you will be missing an opportunity. Pharmaceutical companies are just chemical companies by a different name, because they charge higher prices for their products, right? How many new pharmaceuticals do you ever hear marketed by a chemical name? It is a very well brand-tested name. This principle applies to the solutions to all the Grand Challenges.

Let me describe to you how you could ever get a premium for gasoline. Some people think gasoline is all the same. I will tell you it is not all the same. In 1998, a Shell group thought they could develop something called V Power gasoline. It became a reality and now sells in 70 countries around the world at a premium, after naysayers said it could not be done. I want to stress to you that there is opportunity in branding and to not take it for granted.

I have been emphasizing product brands, but the most impressionable experience for me at DuPont was not with a product brand. We had a great leader named Crawford Greenewalt. I never met him personally but learned a lot from his work. He had the idea that our products would eventually become outdated. If we cease to reinvent our products, our competition would take our markets. As a result, the most critical thing we can do is ensure we are always making new and better products.

He came up with a theory, the Rain Barrel Theory. A rain barrel has holes in the bottom, allowing liquid to flow out. The challenge has always been to keep the rain barrel overflowing at the top. The strategy is do not let the rain barrel run dry. It is not a fancy strategy, although it is a strategy that I remembered and used throughout my entire time with DuPont. As you talk about the processes you are working on, think about what underlying theory driving your work—your Rain Barrel Theory. Brand your process as well as your product.

The last item I want to share is of a very different nature. When you develop your technology, disseminate it quickly, broadly, and everywhere you can. All my training coming up through the chemical industry focused on the idea that "you have to protect your technology." You have to make sure you follow your intellectual property strategy, do not let it come out too early, and do not let your competition get an idea of what you are doing. If we are going to get our fourteen Grand Challenges working, we have to change that paradigm.

One experience that taught me to think two steps ahead was my experience with the ozone hole. You may have heard of it. It was about thirty years ago and was related to chlorofluorocarbons (CFCs). DuPont was a big producer of CFCs. Once the connection between ozone layer depletion and CFCs was proven we had five years to stop producing CFCs, find a replacement, get commercial capacity and have it out in the market place, and supply our customers. This was initiated by the Montreal Protocol.

There was no way we could get that done if we used our normal patent strategy. Our strategy was to go to all of our competitors—why do not we license royalty free to each other, no exceptions. I am not suggesting that is the answer to everything.

In the energy industry, we have these things called remote operated vehicles (ROVs). The ROVs can take 250 times the pressure that you might have at sea level, and they have a robotic arm and lights. One of the biggest challenges of the world is that 70% of the earth is covered in water and 95% has not been explored. Why do not we let scientists and researchers from around the world utilize our ROVs when we are not using them for free? It is in our interest to learn the results of their scientific work.

My guess is that there are many more examples we can find where industry would let scientists use their equipment for free if we could just put the pieces together. I urge you to think about that.

In summary, three suggestions to move from walk to run:

(1) Make sure you talk about the value to people in terms they can understand;
(2) Brand it because people will remember it and you will have a better chance of succeeding with it;
(3) Think about different ways of taking your intellectual property and technology to market, and distributing it much faster than we ever have in the past.

In closing I would like to share one thing that could get in the way of adopting these fourteen Grand Challenges. As engineers, it is one of the most important things we should all remember are our ethical standards. People trust us. We must treasure that trust and do everything to make sure that everything we represent is trustworthy. You will be hit with ethical challenges throughout your career, and you will be hit with ethical challenges while working on these fourteen Grand Challenge projects. Let me give you a very simple test I have used for a long time. Think about a decision you are going to make. If you go back to your manager, boss or the funder of your grant and explain it to them, would you be proud to explain it to them? If it passes that test, then go home and talk to your family and explain it to your family. If you would be proud to explain it to your family, it passes the second test. In the third test, if it was printed on the front page of the newspaper accurately, you do not have to love that, but you would be okay with it? If it passes those three tests, I think it would pass any test you need it to. As engineers, we have to set the ethical standard that people respect us or we will never make our fourteen Grand Challenges a reality.